

# Chapter Five

## COMPARISON TO PREVIOUS STUDIES

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### 5.1 OVERVIEW

The purpose of this section is to compare system-wide studies of Virginia public use airports, which have been released in 1986, 1990, 1996 and 2003. For the latter three studies, the years that the Commonwealth's airport activities are measured precede the release dates by one or two years. To avoid confusion, throughout this comparison the four studies are referred to by the years that have been measured, 1986, 1988, 1995 and 2001. Original research was conducted in 1986, 1995 (for the 1996 release) and 2001 (for the 2003 release). The 1988 data (for the 1990 release) was derived by applying factors based on passenger volume and inflation to the 1986 findings.

The three primary studies of the Commonwealth's airport system were supplemented with analyses conducted on behalf of the Metropolitan Washington Airport Authority (the Authority) for Ronald Reagan Washington National Airport and Washington Dulles International Airport in unrelated projects. The most recent analysis of Authority airports is based on 2002 data. Therefore, the year 2002 will be used when referring to the most recent Authority study and 2001/02 will be used when comparing the most recent studies of entire network of Virginia airports.

The four studies employed different methodologies. Several important distinctions include:

- *The studies measured different aspects of airport impacts.* The 1986 and 1988 studies assessed on-airport operations and tenants, visitor spending, and included capital spending, off-airport freight forwarders and travel agents in the definitions of "primary impacts." The 1995 study limited primary impacts to airport operations, airport tenants and visitor spending.<sup>1</sup> The 2001 study discretely measured the impacts of airport operations, airport tenants, visitor spending and off airport businesses that rely on aviation services at public use airports. In the analysis below, the studies were adjusted to establish a common denominator of airport operations, airport tenants, and visitor spending.
- *The four studies employed three methods of accounting for "spin-off" impacts from primary economic activities.* In the 1986, 1988 and 1995 studies, 10 regions were used to estimate multiplier areas, and the regions are different in 1995 than in 1986 and 1988. For the 2001 study, specific regions were tailored for each of 65 airports studied in cooperation with the VA Department of Aviation. By developing more localized multipliers, the 2001 study is more useful to each airport. Generally, multiplier factors are higher in larger regions (such as when only ten regions are used for the entire state) than

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<sup>1</sup> The 1995 study does not separately account for the impacts of tenants on airport activities.

smaller regions (tailored to a single airport's primary impact area) because there are more goods and services available for purchase in bigger areas than smaller areas. For this comparison, statewide impacts are used and not the sum of spin-off impacts for each airport.

- *The multipliers used to develop state impacts were different in 1986 and 1988, 1995 and 2001.* The 1986 and 1988 studies used RIMS II. The 1995 and 2001 studies used different versions of IMPLAN multipliers, and the statewide multipliers for 1995 were significantly higher than those used in 2001. The implications of the different multipliers will be reviewed below. Research subsequent to the publication of 1995 findings indicate that the IMPLAN multipliers used in that study had a bias toward overstating impacts that are particularly pronounced in the lower paying jobs and part-time jobs that are often found at airports and industries that serve visitors.<sup>2</sup> IMPLAN has made major efforts to improve its model, and the accuracy of the 2001 study is increased because of these improvements.
- *Coupled with the different multipliers, the studies measured impacts of different industries.* All studies aggregated industries to develop blended multipliers. For example, federal government, state government and local government may be combined into a single government sector. The 2001 study was structured to provide the most accurate approach of the four studies to trace the impacts of direct spending in the economy. This various industry aggregations used in the studies are discussed below.
- *The number of airports, the locations of airports and the use of airports (whether general aviation only or supporting both general aviation and commercial service) changed throughout the 15 year research span of these reports.* These differences are particularly important when comparing the “bottom-lines” of individual airports.
- *Conditions beyond the control of individual airports or the Commonwealth's Department of Aviation result in different contexts for each study.* The fourth quarter of 2001 was under the shadow of the September 11 terrorist attacks in New York and at the Pentagon, located in Northern Virginia. Moreover, the national economy was in recession in 2001, further dampening air travel and spending.

## 5.2 ON-AIRPORT ECONOMIC ACTIVITY

*On-airport activities* are economic activities associated with direct spending for airport operations and by tenants of airports, exclusive of any spin-off (or multiplier) impacts. To develop as straightforward a comparison as possible among the four studies, capital expenditures, activities generated by travel agents and activities of off airport freight forwarders were deducted from the base reported as “primary” in the 1986 and 1988 studies.<sup>3</sup> This allows for a comparison of findings in the studies of jobs, wages paid and economic activity (business

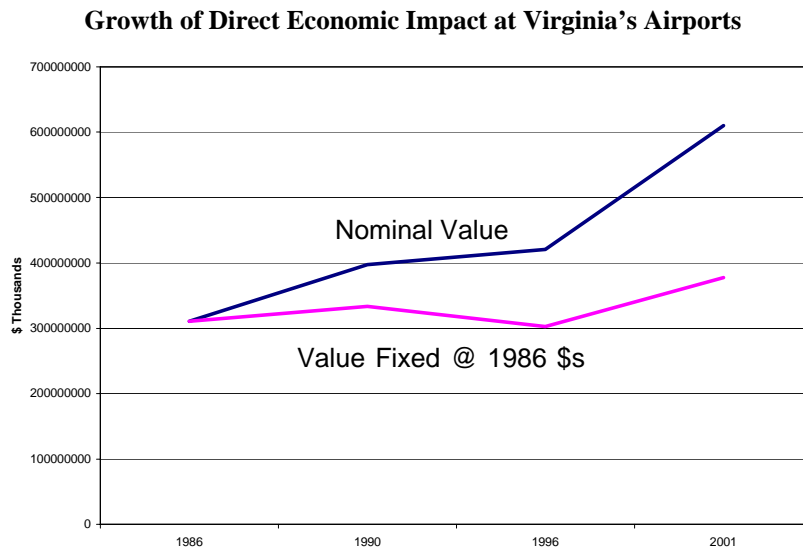
<sup>2</sup> See Stynes, Chang and Propst, National Economic Impacts of CE Recreation Visitor Spending, 2/16/98; and Chang, Potential Bias of IMPLAN Type III Multipliers, Michigan State University, 4/28/1998

<sup>3</sup> Data for Ronald Reagan Washington National Airport and Washington Dulles International Airport were not separately available. Therefore, ratios were assumed that are consistent with the overall profile of these two airports as a proportion of all of Virginia's commercial airports.

sales/budgets) at Virginia's public use airports in 1986, 1988, 1995 and 2001 that were generated by airport operations and aviation related tenants.

Estimates of on-airport jobs, wages and economic activities at Virginia's airports illustrate that the direct economic benefit of the airport system continues to grow. Economic activities generated at the Commonwealth's public use airports have increased from \$311 million estimated in the 1986 system study to \$610 million in 2001. Moreover, when held to constant 1986 dollars, the 2001 real increase is to \$378 million, or roughly 21 percent. (See **Figure 5-1.**) Estimates of wages paid to workers on the Commonwealth's airports increased by 67 percent in constant dollars, which in turn supports more than 3,700 additional jobs. The only negative indicator to report is that the average wage per job at the airports has decreased in real terms from about \$23,000 to under \$21,000, even as overall employment and aggregate payroll has increased. (See **Table 5.1.**)

Figure 5-1



Sources: Economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings for Ronald Reagan Washington National Airport and Washington Dulles International Airport.

Table 5.1

**Jobs and Total Wages Continue to Increase at Virginia Airports**

Study	Jobs	Nominal Value		Constant 1986 \$s	
		Total Wages	Wages per Job	Total Wages	Wages per Job
1986	4,431	\$102,127,000	\$23,048	\$102,127,000	\$23,048
1988	5,119	\$131,284,000	\$25,646	\$110,090,000	\$21,506
1995	5,752	\$154,612,000	\$26,880	\$111,191,000	\$19,331
2001	8,190	\$275,374,000	\$33,623	\$170,418,000	\$20,808

Sources: economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings Ronald Reagan Washington National Airport and Washington Dulles International Airport.

### 5.3 INITIAL VISITOR SPENDING

Initial spending is the actual spending by aviation visitors before any calculation of spin-off impacts, and is based on the following steps:

- Determine the number of visitors using commercial flights and using general aviation
- Calculate spending per visitor to Virginia. Each study calculated spending separately for commercial and GA visitors. This spending is total sales in Virginia directly generated by aviation visitors.
- Apply ratios of jobs-to-sales and wages-to-sales to determine jobs and wages directly generated by visitor spending. These ratios are produced by the econometric models used for each study.

Visitor spending totals per study vary based both on the number of assumed visitors and the approximate amount of spending by each visitor arriving by commercial flight or by general aviation. Moreover, ratios of jobs and wages to sales are derived from models, which also vary significantly across the four studies.

**5.3.1 Number of Visitors.** The four studies show an overall rise in commercial passenger enplanements of close to one-half million passengers, growing from 2.9 million enplanements in 1986 to 3.4 million in 2001. (See **Table 5.2.**) From 1986 to 1995, commercial enplanements increased by more than 223,000 persons and increased again by more than 270,000 through 2001. Each study estimated that about 45 percent of passenger enplanements represented visitors to Virginia, and about 55 percent represented Virginia residents.

General aviation operations at commercial and “general aviation-only” airports were higher in 1986 than in 2001. The studies of 1986, 1988 and 1995 document a steady increase from 1.4 million operations to 1.7 million operations. From 1986 to 2001, however, general aviation operations declined by more than 275,000 bringing the system-wide level under the 1986 benchmark. (See **Table 5.3.**)

Table 5.2

**Estimated Numbers of Commercial Air Visitors to Virginia**

Study	Commercial Enplanements	Change from Previous Study	Percent Visitors	Estimated Total Visitors	Change from Previous study
1986	2,944,000		45.0 percent	1,324,800	
1988	3,230,000	10 percent	45.0 percent	1,453,500	10 percent
1995	3,167,000	-2 percent	45.7 percent	1,446,997	-0.4 percent
2001	3,441,000	9 percent	44.8 percent	1,541,568	7 percent
Change 1986-2001		17 percent		16 percent	

Sources: economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings Ronald Reagan Washington National Airport and Washington Dulles International Airport.

Table 5.3

**Estimates of GA Operations and Visitors to Virginia**

Study	Total GA Ops	Passengers per GA Op	Total GA Passengers	Percent of Ops. True Itinerant	Total Estimated GA Visitors
1986	1,447,000	2.72	3,935,840	N/A	400,000
1988	1,545,000	2.72	4,202,400	N/A	427,091
1995	1,663,000	3.10	5,154,663	28 percent	460,315
2001	1,386,000	3.36	4,658,034	29 percent	679,718

Sources: economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings for Ronald Reagan Washington National Airport and Washington Dulles International Airport.

The studies indicate, however, that more general aviation visitors used Virginia's airports in 2001 than in previous years. Approximations of visitors differ from operations because estimates of true itinerant operations and passengers (including pilot) per operation vary. The 1986 study (and therefore the 1988 study) used a national study as a basis for assuming 2.72 passengers per all GA operations.<sup>4</sup> The 1995 study reported 3.1 passengers per operation for all GA operations based on a survey. In a more nuanced approach in 2001, GA pilots were surveyed in both commercial and GA-only airports. The numbers of GA visitors per operation were then segmented according to the profile of four classifications of airports, air carrier airports (4.45 passengers per operation), reliever and GA regional airports (3.25), community airports (2.0) and GA local service airports (1.50). These averages are consistent with the actual use of the airports as well as the profile of aircraft that use each type of airport.<sup>5</sup> None of the

<sup>4</sup> The 1986 study counted just 400,000 GA visitors, less than 30 percent of those estimated in 1995 and 2001.

<sup>5</sup> Sources for these estimates were GA pilot surveys and consultations with airport managers and VA DOA officials. Overall, the weighted average of passengers per GA operation for all airports is 3.36, and the weighted average of passengers per GA operation at GA only airports is 2.87.

prior studies distinguished passengers per operation at GA-only airports, including those at smaller local service and community airports, and larger commercial airports.

Note that GA operations and visitors arriving on commercial carriers in 2001 were affected by the terrorist attacks of September 11, which was at the outset of the fourth quarter of that year.

**5.3.2 Spending per Visitor.** In constant dollars, visitor spending estimates per trip were higher in the 1986 study than in 1995 and 2001 for visitors arriving by commercial flights and general aviation. One reason for this is that the 1986 study relied on the National Travel Survey and the OAG Travel Planner, whereas estimates in the latter two studies were based on passenger surveys in Virginia. Comparing the 1995 and 2001 studies in constant dollars shows spending estimates per air carrier visitors were \$51 lower in 2001 than 1995, but that estimates of spending per general aviation visit were \$31 higher than estimated in 1995. (See **Table 5.4**.)

Table 5.4

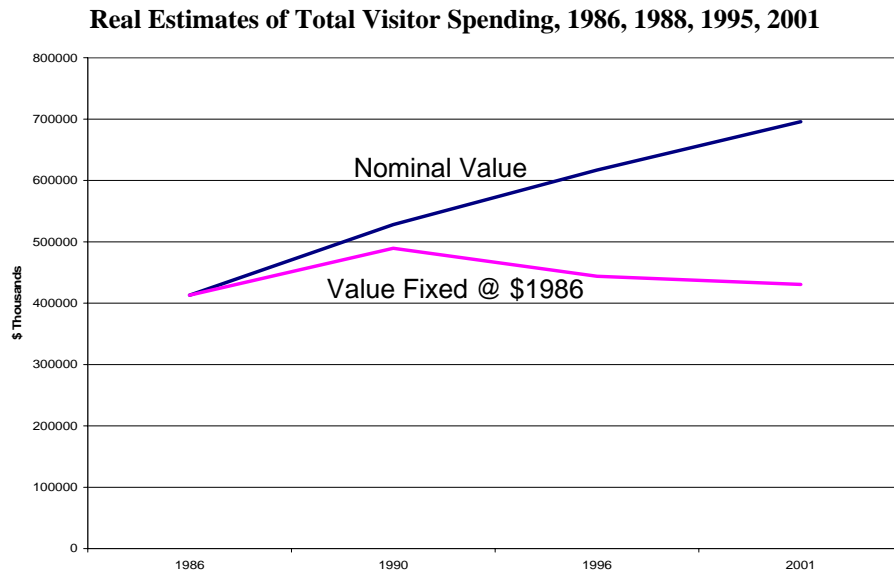
**Estimates of Spending per Commercial Air Visit and General Aviation  
Air Visit**

Study	Commercial Visits		General Aviation Visits	
	Nominal \$s	Constant 1986 \$s	Nominal \$s	Constant 1986 \$s
1986	\$341.54	\$342	\$115.00	\$115
1988	\$375.69	\$348	\$126.50	\$117
1995	\$403.12	\$290	\$ 71.36	\$ 51
2001	\$386.84	\$239	\$130.99	\$ 81

Sources: economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings for Reagan Ronald Reagan Washington National Airport and Washington Dulles International Airport.

**5.3.3 Total Visitor Spending and Impacts.** Real estimates of total visitor spending have been relatively stable from 1986 to 2001. Visitor spending accounted for about \$700 million in visitor spending in 2001, and in constant dollars these totals exceed those reported in the initial 1986 study by about 5 percent. The 1988 study reported a significant bump upward in the dollar volume of visitor spending, which has been corrected in subsequent studies. (See **Figure 5-2**.) Overall, the higher number of commercial and GA visitors serve to increase the impacts of visitor spending in 2001 compared to previous years, though these impacts are curbed by lower spending estimates per visit, especially by commercial visitors.

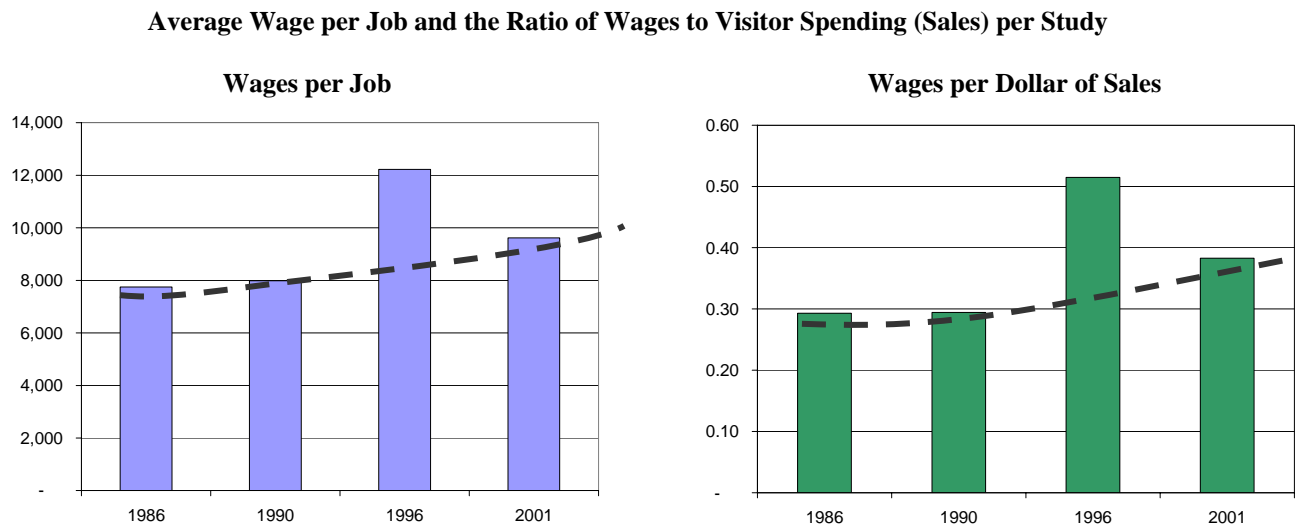
Figure 5-2



Sources: economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings for Ronald Reagan Washington National Airport and Washington Dulles International Airport.

Illustrated by **Figure 5-3**, the average wage per job and the ratio of sales to jobs are much higher in 1995 than the preceding studies, and the increase is moderated in 2001. The higher ratios of wages to visitor spending (sales) in 1995 drives the higher economic impacts derived from visitor spending for that study.

Figure 5-3



Note: Dashed line illustrates trend excluding 1995, which included assumptions inconsistent with other studies.

Sources: economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings for Ronald Reagan Washington National Airport and Washington Dulles International Airport.

## 5.4 SPIN-OFF IMPACTS

The spin-off (multiplier) impacts in the Virginia economy that are generated from the Commonwealth's public use airports are presented in **Table 5.5** (except for Ronald Reagan Washington National Airport and Washington Dulles International Airport). The ratios of both "jobs to sales" and "wages to sales" used in the 2001 study are roughly mid-range between the ratios used in 1986/88 and 1995, as described below:

- **Sales per job:** the 2001 ratio of more than \$50,000 of sales per job fall between the 1986 results of \$98,000 and the \$36,000 findings in 1995.
- **Wages per \$1.00 of economic activity:** the 2001 study reports that workers in the Virginia economy receive \$.35 for every dollar of spin-off economic activity. These results fall between the 1986 findings that indicate that workers received just \$.17 in compensation per dollar and 1995 findings, which reported \$.44 of income per dollar of spin-off activity.

Table 5.5

### Estimates of Spin-Off Impacts (Excluding Direct Impacts)

Study	Employment	Income in 1986\$
1986	9,100	\$151,241,000
1988	10,400	\$159,910,000
1995	23,500	\$367,734,000
2001	13,500	\$234,906,000

Sources: Economic impact studies of Virginia airports released in 1986, 1990, 1996 and 2003. Calculations by EDR Group. These data do not include findings for Ronald Reagan Washington National Airport and Washington Dulles International Airport.

## 5.5 OFF-AIRPORT DEPENDENT BUSINESSES

Virginia businesses use public use airports for passenger and freight services, even if many of these enterprises do not produce aviation related products or services. To measure the air-dependency of off-airport businesses on public use airports, the 2,000 largest businesses in the Commonwealth were surveyed, as were additional businesses identified by airport managers. This type of analysis was not matched in any of the preceding studies.

The 2001 Virginia Department of Aviation study also surveyed businesses in-state to determine the extent to which they rely on the Commonwealth's public use airports (exclusive of the Authority). These are businesses that are not directly aviation related, but rely on Virginia's public use airports for business travel and/or air freight services. The study documents that these non-aviation businesses rely on the Commonwealth's public use airports for more than \$1.1 billion of economic activity, including almost \$400 million paid to over 11,000 Virginia workers. Spin-off impacts throughout the Virginia economy double these impacts to more than \$2.2

billion of economic activity, which in-turn yields 23,000 jobs and almost \$800,000 in wages. (See **Table 5.6** below.) These data were compiled by a survey and do not include business use of Ronald Reagan Washington National Airport and Washington Dulles International Airport.<sup>6</sup> Please note that the \$ 1.1 billion of direct business sales attributable to public use airports are the actual results of the survey, and this study did not expand the findings from this sample to cover the whole Virginia economy.

The 1995 study surveyed non-aviation businesses, but presented a qualitative report and did not develop economic findings. Overall, the study estimated that over 500,000 jobs in Virginia “are related” to aviation (including Ronald Reagan Washington National Airport and Washington Dulles International Airport).

The 1986 and 1988 studies measured air-related sales (commissions), income and employment of travel agents and freight forwarders, but did not attempt to document more widespread business dependency on aviation. The 1986 study found that the aviation portion of travel agents and freight forwarders businesses were responsible for about \$62 million in sales, of which \$25 million were wages paid to over 1,600 workers.

Table 5.6

**Economic Impacts of Air-Dependent Businesses in Virginia that are Off-Airport**

	2001 Nominal \$\$	1986 \$\$
<b>Direct Impacts</b>		
Sales	\$1,155,425,000	\$715,046,000
Income	\$ 391,536,000	\$242,306,000
Employment	11,300	11,300
<b>Spin-off Impacts</b>		
Sales	\$1,112,632,000	\$688,563,000
Income	\$ 381,643,000	\$236,183,000
Employment	12,300	12,300
<b>Total Contribution to VA Economy</b>		
Sales	\$2,268,057,000	\$1,403,608,000
Income	\$ 773,179,000	\$ 478,489,000
Employment	23,600	23,600

**Note:** These data are underestimates that reflect the count of survey respondents and are not inflated to account for the overall VA economy.

Sources: HNTB and EDR Group, economic impact study of Virginia airports released in 2003. Calculations by EDR Group. These data do not include findings for Ronald Reagan Washington National Airport and Washington Dulles International Airport.

**Table 5.7** summarizes the combined economic contribution to Virginia made by Ronald Reagan Washington National Airport and Washington Dulles International Airport to the Virginia

<sup>6</sup>The survey instrument asked businesses to estimate the percent of their business activities that rely on GA, commercial air passenger and freight transportation at the Commonwealth’s public use airports. Reported results include only those portions that are reliant.

economy. Though showing slight declines from 1995, the overall contribution of the Authority airports to Virginia has increased by factors of almost 3 for employment and 4 for wages and economic activity from 1986, as reported in the four studies. The decline in 2001 might be attributable to the aftermath of the September 11 attacks.

Table 5.7

**Total Economic Contribution of Authority Airports to the Virginia Economy**

Study Year	Employment (including spin-off impacts)	Income (including spin-off impacts)	Sales (direct only – no spin-off impacts)
		Fixed 1986 dollars in thousands	
1986	34,252	525,476	979,344
1988	46,527	730,075	1,358,423
1995	109,740	1,906,307	4,247,251
2002	101,740	1,949,067	3,765,520

Sources: The U.S. Consumer Price Index, United States Bureau of Labor Statistics. Martin Associates, Summary 2002 Economic Impacts, Table 1-1; Economic Impact of Aviation in Virginia, 1996, Tables 11, 15, 19; Virginia Air Transportation System Plan: Economic Impact Study, 1990, Table 5.6-2; and Virginia Airports, an Economic Advantage, 1986, Table 5.1. See Tables ES-1 and ES-2 for a review of how VA impacts were calculated for IAD and DCA. Calculations by EDR Group and HNTB.

## 5.6 CONCLUSION

Trends over the past 16 years demonstrate the growing importance of Virginia's public use airports to economy of the Commonwealth. There is every reason to believe that the importance of air transportation will continue to grow as services increasingly become an export-economic sector that requires inter-regional, inter-state and international transportation, and just-in-time cargo delivery expands throughout the world economy.

Though economic impacts represented by Ronald Reagan Washington National Airport and Washington Dulles International Airport appear to have declined slightly in 2001 from 1995, the contributions of airports under the aegis of the Commonwealth's Department of Aviation are growing. Jobs, wages and economic activity (the latter two in constant dollars) are higher today than they were in 1986. Commercial enplanements are higher, and the Commonwealth is seeing more aviation visitors, though 2001 general aviation operations decreased in the context of a recession and the aftermath of the terrorist attacks of September 11.

Comparing the four studies also show that economic evaluation techniques have become more sophisticated over time. They have become more nuanced in terms of geographical impact areas and categories of impact that are measured. Accuracy has also increased as econometric tools have improved and the pool of modeling literature has expanded. These improvements should carry over to future aviation studies in Virginia.

The contribution of airport-related services to the Commonwealth's economy has increased from 1986 to the present after major differences in methodologies are adjusted,<sup>7</sup> but the peak results are reported in the 1995 study. (See **Table 5.8**.) From 1986 to 2001/02 economic activity generated by on-airport and visitor spending increased by 60% in real value adjusted for inflation. In addition, the increase from 1998 to 2001/02 is almost 22% in adjusted dollars. This is illustrated in **Figure 5-4**.

Table 5.8

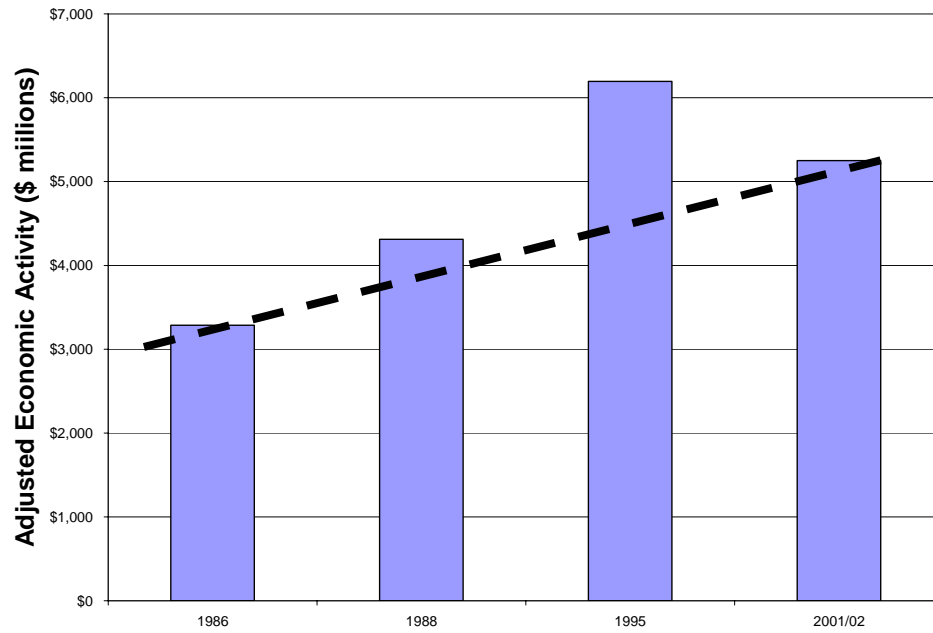
**Economic Contribution of Public-Use Airports to Virginia**

Year	Constant 1986 Dollars	
	Wages	Economic Activity
1986	\$1,056,178,000	\$3,287,398,000
1988	\$1,412,146,000	\$4,310,498,000
1995	\$2,885,328,000	\$6,196,534,000
2001/02	\$2,519,273,000	\$5,250,250,000
Sources: U.S. Consumer Price Survey, Bureau of Labor Analysis. EDR Group (for 2001), Martin Associates (for 2002), AirTech (for 1995) and SH&E (for 1986 and 1988).		

<sup>7</sup> Data for the 2001/02 study do not include off-airport aviation reliant businesses. Adjustment were made to the 1986 and 1988 studies to exclude impacts of travel agents and off-airport freight forwarders. The 2002 The Authority study does not report spin-off business sales generated. Spin-off sales are reported for Ronald Reagan Washington National Airport and Washington Dulles International Airport in the overall system studies of 1986, 1988 and 1995. Spin-off impacts for employment and wages are reported in all studies, however. For the purpose of consistency spin-off business sales were deleted for this comparison.

Figure 5-4

**Trend of Economic Contribution of Public-Use Airports to Virginia, 1986 – 2001/02**



Sources: See Table 5.8 above. Adjustments were made so that each study reflected similar activities, including airport management, airport tenants and visitor spending (see footnote 7).